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BUSINESS DEVELOPMENT IN RENEWABLE ENERGY CASE STUDY: INDEPENDENT POWER PLANT (IPP) OF MARINE CURRENT TURBINE PT T-FILES INDONESIA

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Abstract— Indonesia is experience a surplus in generating capacity of up to 27TWh by 2014 and makes this country struggling to provide electricity for its currents needs that sometimes give delays in capacity development (including with Independent Power Producer (IPP) projects). There are around 20 million households, or 80 million people, who currently have no access to public electricity. This study intends to find out what renewable energy in Indonesia in accordance with the potential that exists with case studies ocean current turbine power plant owned by PT T-Files Indonesia. This plant uses Gorlov turbine with a permanent magnet generator. Specifically this study aims to determine the feasibility of ocean current turbine power plants can be private power plants that sell electricity to PT PLN (Persero) to meet the electricity demand in Indonesia. Calculation of the cost of electricity per kilowatt-hour sales done in the conventional way with the ABCD method is the removal of the component C fuel component. Eligibility is done by searching IRR, NPV and PP from the power plant. Thus obtained if the power plant is feasible or not. Feasibility of the calculation found that the power plant is feasible electricity sales. Plan implementation is done by making 1-year period and electricity sales contracts for 15 years. It can be concluded that the development of electricity generation from renewable energy is feasible for IRR, NPV and PP meet.

Keywords: business development, renewable energy, power plant, marine current

1. Introduction

A. Electicity in Indonesia

Indonesia is now experience a growth economic condition after the global financial crisis that made the GDP growth rate increase and forced an unprecedented degree of urbanization and industrialization. The growth in urbanization and industrialization also increase the demand for electricity that forecasted to increase at 7% to 9% p.a. in the future. In other words, the electricity demand will grow into 167TWh by 2014. The capacity of generator in Indonesia is forecasted to increase into 194TWh by 2014 (while still accounting for only approximately 2% of power generation in the Asia region).

More than 75% of energy electricity is produced by using fossil fuel, coal, and natural gas. The amount of those energy sources is limited, so we must develop other form of energy as an alternative energy source. There are several types of alternatives energy source, such as nuclear reactor, wind, solar cell, hydro, sea wave, and Marine Current.

The reasons behind this under development include:

a) The lack of development of distribution and transmission infrastructure (e.g. gas pipelines, coal transportation routes, distribution networks, etc.) which are use to bring the feed stock together

with the generating assets to the consumer, especially in areas outside of the islands of Sumatra, Java and Bali;

b) The historical dificulties in obtaining land for electricity assets including the necessary land use rights and achieving the associated land clearing;
c) The lack of a strong regulatory framework especially to allow access to project-based financing in the international market place. On this point, a particular concern has been the absence of sovereign or similar guarantees over the key revenue streams
d) The lack of market pressures yielding proitable prices due to subsidies that causes power to be sold at prices less than the fuel cost of power generation.

B. Energy Mix

More than 75% energy of electricity is produced by using fossil fuel, coal, and natural gas. The amount of that source is limited and nearly depleted, so we must develop other form of energy as an alternative energy source. There are several types of alternatives energy source, such as nuclear reactor, wind, solar cell, hydro, sea wave, and marine current.

Energy Mix in Indonesia from year to year is seen in Figure 1.4 that occurs on increasing renewable energy generation by coal despite increased. For petroleum generation decreased in 2009 due to rising world crude oil prices.

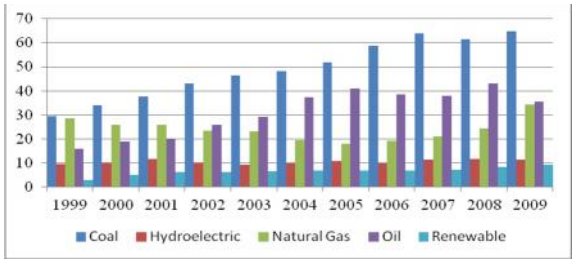

Figure 1.4. Electricity Production from Sources,
(World Bank, 2010)

Renewable energy built many power plants from hydropower in Indonesia is because Indonesia has many rivers and streams that can drive the turbines. Then geothermal, Indonesia has an active mountain range. Hydro which involves a series of mini-hydro, micro-hydro and pico-hydro was developed in 2000 as well as biomass.

Table 1.1 Implementation of Renewable Energy Development,
(Muthasor, 2012)

No	Renewable Energy	Resources	Installed Capacity	Ratio
1	Water	75.670 MW	5,711 MW	7.54
2	Geothermal	29.038 MW	1,189 MW	4.00
3	Hydro	769,69 MW	228.75 MW	28.31
4	Biomass	49.810 MW	1.618.40 MW	3.25
5	Solar	4,8 kWh/m2/day	13.5 MW	-
6	Wind	3 – 6 m/s	1.87 MW	-
7	Ocean	Theoretical =	-	-

		749.000 MW Technical = 49.000 MW Practical = 43.000 MW		

C. PT T-Files Indonesia

PT. T-files Indonesia becomes an alternative energy company since 2005 that has a commitment to build non conventional energy source especially in Indonesia. At present, Indonesia only used a fossil fuel, and coal as electric energy source. In the other hand the fossil fuel and coal is limited, and produce a lot of pollutant.

Electricity needs is growing every time, therefore we must search alternative energy source to anticipate it. There are several alternative energy sources as mention before. Marine current energy is the most appropriate energy source for a country which has a big area of marine like Indonesia.

Vision of PT. T-Files Indonesia is become an alternative energy company which has full commitment to provide nonconventional energy to the world.

Mission of PT. T-Files Indonesia are:

1. Help the government to provide electric supply, for industry or home using
2. Show to the International public that Indonesia have active participation in technology application to take benefit from natural resources
3. Being participated in alternative energy research in Indonesia.
4. Reduce pollution from fossil energy source.

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Web : www.tfiles-indonesia.com

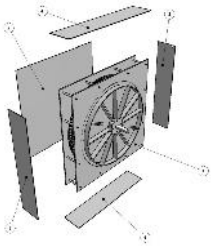
We have 5 works sites, namely Office, Research, Fabrication and manufacture. Following are the location of the Office, Laboratory and Workshop of PT. T-Files Indonesia.

Type : Gorlov
Dimension :
- Diameter 1 m
- Height 1,2 m

Efficiency : 30 %
Material : Fiberglass Epoxy

Figure 1.4. Marine Current Turbine Developed by PT. T-Files Indonesia

To generate power from the turbine, PT. T-Files Indonesia has develop permanent magnet generator specialized design for low velocity rpm as seen in figure 1.5. This generator, in present condition, will be able to generate rated power of 10 kW.



Type : *Pemanent Magnet Generator*
Dimension :
- Diameter rotor 1 m
- Length 1,2 m
- Width 1,2 m

Max Output : 20.000 VA
Rated Output : 10.000 VA

Figure 1.5. Marine Current Generator Developed by PT. T-Files Indonesia

To support generator and turbine, and also act as buoyancy, PT. T-Files Indonesia also develops a floating structure. Structure is designed in modular for mobility reason and easy maintenance. For maintenance structure part that holds the turbine and generator can be lifted to conduct maintenance.

2. Business Issue Exploration

D. Renewable Energy

More than 75% energy of electricity is produced by using fossil fuel, coal, and natural gas. The amount of that source is limited, so we must develop other form of energy as an alternative energy source. There are several types of alternatives energy source, such as nuclear reactor, wind, solar cell, hydro, sea wave, and Marine Current.

Table 2.1 Comparison between several energy sources
(Emilly, R. 2001)

Energy Sources	Renewable resource	Low capital cost	Low running cost	Minimal environmental impact	Predictable	Minimal visual impact	Modular
Fossil	No	Yes	No	No	Yes	No	No
Nuclear	No	Yes	No	No	Yes	No	No
Wind	Yes	No	Yes	Yes	No	No	Yes
Solar	Yes	No	Yes	Yes	No	No	Yes
Hydro	Yes	Yes	Yes	No	Yes	No	No
Wave	Yes	No	Yes	Yes	No	Yes	Yes
Marine Current	Yes	No	Yes	Yes	Yes	Yes	Yes

Double-track strategy from Muthasor, 2012

1. Acceleration of equity of access to energy
   Limited access to electricity to 80 million people in the islands, remote or border.
   Ocean energy to be one option, taking into account other sources of energy, for the provision of adequate electricity.
2. Reduced reliance on fuel
   Subsidies amounting to 15% Budget and ocean energy price competitive against gasoline.
   Development of marine energy medium and large scale

E. IPP Price Component

IPP Price component consist of 3 component cost, there are:

1. Component A is Investment Cost, Machine and Infrastructure Investment cost
2. Component B is Operational and Maintenance Cost, Fixed and Variable

3. Component C is Fuel Cost

In renewable energy component C, fuel cost do not include in calculation, because value of fuel cost is zero.

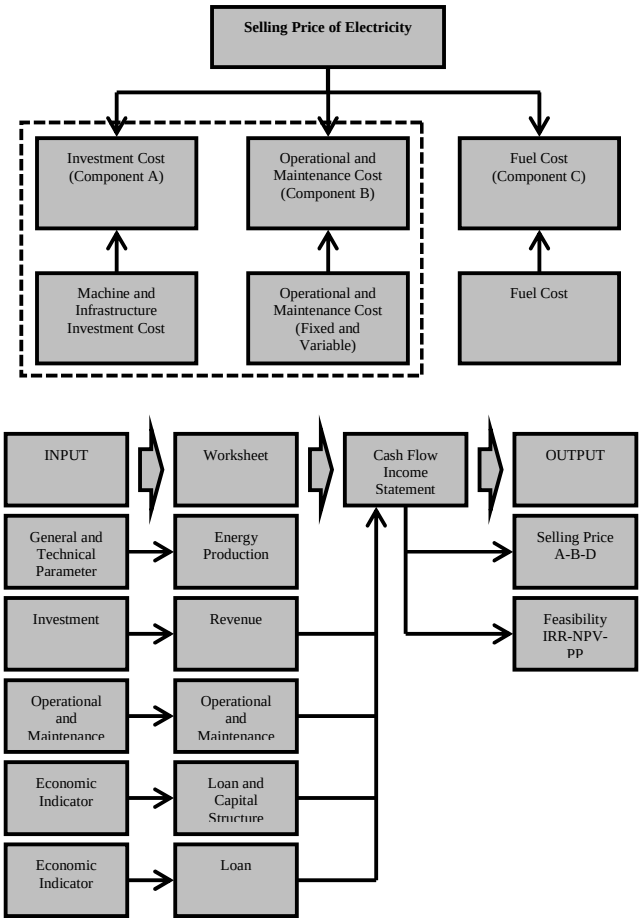


Figure 2.3 Framework of IPP Price

F. Financial Analysis

The formulae used are based on standard financial terminology that can be found in most financial textbooks, such as Brealey and Myers (1991). The model makes the following assumptions:

1. The initial investment year is year 0;
2. The costs and credits are given in year 0 terms, thus the inflation rate (or the escalation rate) is applied from year 1 onwards; and
3. The timing of cash flows occurs at the end of the year.

3. Business Solution

G. Alternative of Business Solution

The cost to build this plant will cost as follows:

Initial Cost	Amount	Percentage
Feasibility study	$ 500.000	11,5%
Development	$ 198.500	4,5%
Engineering	$ 55.100	1,3%
Power system	$ 1.770.000	40,5%
Balance of system	$ 1.842.930	42,2%
Total Initial cost	$ 4.366.530	100%

The annual cost to be incurred in order to plant it runs as follows:

Annual Cost	Amount
Operational and Maintenance	$ 88.132
Debt payment – 10 years	$ 563.294
Total Annual cost	$ 651.426

Financial Parameter
General

Parameter	Amount
Inflation rate	2,0%
Discount rate	10,0%
Project life	15 years

Assumptions used for inflation was 2% per year with a discount rate of 10% and the plant is working in 15-year contract

Finance

Parameter	Amount
Debt ratio	70%
Debt interest rate	13,00%
Debt term	10 years

Debt ratio of 70% is the maximum loan from the bank debt interest rate of 13:00% per year for 10 years.

Income tax analysis

Parameter	Amount
Effective income tax rate	10%
Depreciation method	straight line
Depreciation period	15 years

Effective income tax rate of 10% equated with VAT in Indonesia. Depreciation of plant and method of straight line depreciation is assumed for 15 years in accordance with the length of the contract. But it is not possible that this plant can work more than 15 years.

Annual income
Electricity export income

Parameter	Amount
Electricity exported to grid	4.380 MWh
Electricity export rate	$ 200/MWh
Electricity export income	$ 876.012

Electricity export rate of $ 200 per MWh or $ 0.20 per KWh is the result of consultation and negotiation between us with PT PLN (Persero), so that the electricity exported to the grid of PT PLN (Persero) amounting to 4,380 MWh per year found that the electricity export income of $ 876 012 per year.

Financial Viability

Pre-tax IRR – equity	19,6%
Pre-tax IRR – assets	3,2%
After-tax IRR – equity	16,2%
After-tax IRR – assets	1,4%
Simple payback	5,5 years

Equity payback	7,8 years
Net Present Value (NPV)	$ 715.415
Annual life cycle savings	$ 94.058/year
Benefit-Cost (B-C) ratio	1,55
Debt service coverage	1,39
Energy production cost	$ 176,14/MWh

4. Implementation Plan

Implementation of IPP power plant ocean current turbine has a number of stages performed. Since the joint operation with PT INTI (Persero) turbine is almost known by all the people of Indonesia. Several foreign companies had been interested to buy this product.

The IPP has been implemented for the MoU between PT T-Files Indonesia with PT PLN (Persero) Batam branch whose content is PT PLN (Persero) Batam branch will buy electricity from PT T-Files in Batam Indonesia for lighting and surroundings. Power plant manufacturing operation is currently in the phase of the IPP contract documents. Manufacture of power plant of 1MW made within 1 full year with financing from Bank Mandiri (Persero) and implemented in the factory of PT INTI (Persero).

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